3.1 PLAN FORMULATION AND METHODOLOGY

The Corps' planning process is a two-tiered process consisting of a *reconnaissance phase* and a *feasibility phase*. Both phases are used to evaluate the project's economic and environmental viability and optimization. The primary purpose of the reconnaissance phase is to determine whether there is potential Federal interest in any proposed project alternatives and to identify a non-Federal sponsor. If a potential Federal interest is identified in the *reconnaissance phase*, further formulation, evaluation, and comparison of alternatives is performed in the *feasibility phase*, resulting in the selection of a recommended alternative.

For the Upper York Creek Ecosystem Restoration Project, the Corps completed the reconnaissance phase with findings documented in the March 2002 Preliminary Restoration Plan (PRP). The findings from the reconnaissance phase indicated a potential Federal interest and recommended several alternatives for further evaluation in the feasibility phase.

Discussed together, the reconnaissance phase and a feasibility phase make up the Corps' Planning Process. This planning process is described in the 6 steps listed below:

1) Specification of water and related land resource problems and opportunities (relevant to the planning setting) associated with the Federal objective and State and local concerns.
2) Inventory, forecast and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.
3) Formulation of alternative plans
4) Evaluation of the effects of the alternative plans
5) Comparison of alternative plans
6) Selection of the recommended plan based upon the comparison of alternative plans.

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the Corps' planning process. These steps are often referred to collectively as *Plan Formulation.* Plan Formulation is a highly iterative process that involves cycling through the formulation, evaluation, and comparison steps many times to develop a reasonable range of alternative plans and then narrow those plans down to a final array of feasible plans from which a single plan can be identified for implementation.

To facilitate the plan formulation process, the methodology outlined in the Corps' Engineering Regulation 1105-2-100, "Planning Guidance Notebook," 22 April 2000, was used. This process is summarized below:

1) Formulate and screen management measures (referred to hereafter simply as measures) to achieve planning objectives and avoid planning constraints. Measures are the building blocks of alternative plans.
2) Formulate, evaluate, and compare an array of alternative plans to achieve ecosystem restoration.
3) Identify a feasible plan that reasonably maximizes net National Ecosystem Restoration (NER) outputs (outputs minus costs). The plan that reasonably maximizes NER is called the NER plan.

When the tentatively recommended alternative has been confirmed, the study would proceed to develop more detailed design and cost estimates for that plan, which would be presented in the Draft Detailed Project Report. An accompanying Draft Environmental Assessment (EA) would provide a detailed discussion of the environmental analysis for the recommended alternative.

Table 3.1. Current Project Schedule

Milestones	Schedule
Complete Draft Report	August 2006
Public Review	September 2006
Final Report	October 2006
Division Engineer Notice	October 2006
Execute Cost-Sharing Agreement PCA	November 2006
Complete Design and Implementation	March 2007
Complete Real Estate Acquisition	Dec 2006
Advertise Construction	May 2007
Construction Start	June 2007
Complete Construction	October 2008
Turnover Project to Local Sponsor	October 2008
Initiate Monitoring and Adaptive Management	March 2007
Complete Monitoring and Adaptive Management	August 2010

3.2 PLANNING CRITERIA

Planning criteria are used to formulate, screen, evaluate, and compare measures and alternative plans. Four specific screening criteria are required in Corps water resource studies: completeness, effectiveness, efficiency, and acceptability. These criteria are generally subjective and are useful in narrowing down the array of possible alternative plans. With the exception of completeness, these criteria are also useful in screening potential measures.

- Completeness. Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the project. It is an indication of the degree to which the outputs of the plan are dependent upon the actions of others. Plans that depend upon the actions of others to achieve the desired output were dropped from consideration.

- Effectiveness. Effectiveness is the extent to which a measure or alternative plan achieves the planning objectives. Measures or alternative plans that clearly make little or no contribution to the planning objectives were dropped from consideration.

- Efficiency. Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits. Benefits can be both monetary and non-monetary. Measures or alternative plans that provided little benefit relative to cost were dropped from consideration.

- Acceptability. Acceptability is a measure of the ability to implement a measure or alternative plan. In other words, acceptability means a measure or plan is technically, environmentally, economically, and socially feasible. Unpopular plans are not necessarily unfeasible, just disliked. Measures or plans that were clearly not feasible were dropped from consideration.

Measures and plans that pass the screening criteria are evaluated and compared against more specific evaluation criteria. Evaluation criteria are described later in Section 3.12. Evaluation criteria can include costs, outputs, or effects and reflect the planning objectives or constraints. Some or all of the evaluation criteria may be used at various stages in the plan formulation process to compare alternative plans. Effective evaluation criteria must be measurable and reveal differences or trade-offs between alternative plans.

3.3 FEDERAL OBJECTIVES

Ecosystem restoration is one of the primary missions of the Corps of Engineers Civil Works program. The Corps objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units). These net changes are measured in the planning area and in the rest of the Nation.

3.4 PUBLIC CONCERNS

A number of public concerns have been identified during the course of Upper York Creek Dam removal study. Public concerns for this project have been gathered formally and informally from stakeholders. The non-Federal sponsor, the City of St. Helena, regularly represented the general public that would be affected by changes along York Creek. A formal public meeting will be held in Summer 2006 to present the draft DPR in order to gather public comment.

Stakeholders who have attended regular project team meetings and contributed to the formulation of public concerns, problems, opportunities, constraints, measures, and alternatives include the following:

- U.S. Army Corps of Engineering Regulatory Branch (Corps Regulatory)
- California Department of Fish and Game (DFG)
- California Regional Water Quality Control Board (RWQCB)
- City of St. Helena (City)
- Department of Water Resources (DWR)
- Napa County District Attorney's office
- National Marine Fisheries Service (NMFS)
- United States Fish and Wildlife Service (USFWS)

3.4.1 ECOLOGICAL CONCERNS

- NMFS has recognized that Upper York Creek Dam is a complete barrier to upstream fish migration and specifically blocks passage for federally listed steelhead (Oncorhynchus mykiss) in the threatened Central California Coast (CCC) Evolutionary Significant Unit
- York Creek is one of the most significant spawning and rearing streams for steelhead within the Napa Basin (NCRCD, 2005).
- The channel of York Creek that is blocked by the dam offers excellent rearing and spawning habitat. Creating access to these areas will greatly benefit the overall steelhead population (NCRCD, 2005).
- Approximately 26,000 cubic yards of sediment has accumulated behind the dam. In the past, 4 documented uncontrolled releases of the accumulated sediment from the reservoir have caused kills of fish and other aquatic organisms. The most recent silt discharge occurred in July 1992 during routine maintenance of the reservoir outlet structure. A solution is needed to remedy sedimentation issues. Future flood events could cause additional releases and fish kills.
- Water quality and the avoidance of downstream turbidity during construction is a concern.
- There is potential for the occurrences of endangered species including the California freshwater shrimp, California red-legged frogs, and California spotted owl at the project location.
- ESA Consultation: NMFS is concerned with "take" as defined by the ESA of steelhead. "Take" could occur with certain construction practices and because of pumping and diverting water around the construction site.
- Restoration should mimic the natural stream configuration, limit the use of riprap, and not use walls or gabions.
- There is interest in preserving large redwood trees at the project site.

3.4.2 SEDIMENT CONCERNS

- Sediment would need to be sampled and tested so that concerns about contaminants can be thoroughly evaluated. This would also be important for determining how the sediment can be disposed of or used.

3.4.3 STABILITY CONCERNS

- Streambank and streambed erosion after dam removal should be considered during planning and design.
- Mountain Spring road is adjacent to the project site and is a major route connecting St. Helena to Highway 101 and the City of Santa Rosa. Any project work done by the Corps need to account for slope stability concerns in the project area so that the road is not at risk in the future.
- Resource agencies have expressed concern about the Corps' use of hardened structures and use of concrete.

3.4.4 LEGAL CONCERNS

- After the 1992 sediment discharge, the DFG filed a complaint with the Napa County District Attorney. In 1993, DFG and the Napa County District Attorney's Office obtained an injunction in State Superior Court ordering the City to remove Upper York Creek Dam. Because of this legal action, the City of St. Helena agreed to a settlement in 1993 that mandated the removal of Upper York Creek Dam.
- The Superior Court of Napa County dismissed the injunction against the City. The dismissal of this injunction has allowed the City to partner with the Corps' Civil Works Program, San Francisco District, to begin a study on the removal and restoration of Upper York Creek Dam.
- To show the District Attorney's Office that the City of St. Helena is making best efforts to remove the dam, the City would like the project constructed in a timely manner. Draft notes from the "Stakeholder Workgroup Meeting" on February 28, 2001 note that the City was to show the DA's office that it is "making best efforts to remove the dam" by summer 2002.

3.4.5 OTHER CONCERNS

- Because dam was constructed circa 1900, it is considered a historical structure. There is some question about whether the masonry work or design of the outlet structure is of importance.
- It is unknown whether there are archaeological resources near the site that might be impacted by project.
- Noise and safety issues due to truck traffic should be addressed.
- The window for in-stream construction work is June 15 to October 15 of each year.
- Hauling traffic will be subject to potential delays and re-routing beginning in mid-September as wine production traffic increases during harvest and crush.
- Modification to the dam and construction activities should strive to not compromise the integrity or stability of utilities.

3.5 PROBLEMS AND OPPORTUNITIES

The evaluation of public concerns, as described in the previous section, often reflects a range of needs, which are perceived by the public. This section describes those needs in the context of problems and opportunities that can be addressed through the Corps' water and related land resource management.

Problems are undesirable conditions to be changed through the implementation of an alternative plan. Opportunities are positive conditions to be improved by an alternative plan. The difference between problems and opportunities is often simply a matter of perspective. For each problem and opportunity, the existing conditions and the expected future conditions are described.

On July 9, 2003, the Corps' project delivery team (PDT) met to brainstorm Problems, Opportunities, Objectives and Constraints associated with the project. The next sections list the finalized versions of the problems and opportunities that were initially discussed in 2003. For more information regarding the synthesis of the plan formulation of UYC, please refer to Appendix L: Plan Formulation.

3.5.1 PROBLEMS

- **PROBLEM: Upper York Creek Dam is an impassible barrier for fish and aquatic wildlife.**

  Upper York Creek Dam is approximately 50 feet high and 140 feet long and has been identified by NOAA Fisheries as a completely impassable barrier to approximately 2 miles of upstream migration and spawning habitat for the federally listed CCC steelhead. The channel of York Creek that is impacted under the current conditions is known to provide spawning and rearing habitat for CCC steelhead. The dam also blocks access and dispersal patterns for resident fish and other aquatic wildlife to suitable aquatic habitat above and below the dam (i.e. amphibians, other, fresh water shrimp, turtles, aquatic invertebrates, etc).

  Future without project conditions assumes that Upper York Creek Dam would not be removed. The existing dam would continue to be an impassable barrier for fish passage to upstream spawning habitat for the federally listed steelhead. Additionally, the presence of the dam and sediment basin creates an unnatural dispersal barrier to for resident fish and other aquatic species.

- **PROBLEM: Four documented releases of accumulated sediment trapped behind Upper York Creek Dam have caused downstream habitat degradation and fish kills. There is a potential for future releases and fish kills.**

  It is estimated that approximately 26,000 cubic yards of accumulated sediment is trapped behind the dam and that an additional 1,300 cubic yards continues to accumulate annually (Appendix A: Hydrology and Hydraulics).

According to a DFG letter dated July 30, 1992, there have been accidental sediment releases in 1965, 1973, 1975, and 1992. In each incidence, "dense anaerobic sediments, high in toxic hydrogen sulfide, were released from the dam and deposited in pools and riffle areas downstream, quickly suffocating and burying all fish and aquatic invertebrates within a mile or more of the dam" (DFG, July 30, 1992).

Most recently, the 1992 catastrophic accidental release resulted in a silt discharge "within the stream bed from the face of the dam to a point where the Napa River joins the stream" (DFG, July, 1992). The total distance of impact was approximately 2.5 to 3 miles long. The depth of the silt deposits varied from heavy deposits (up to 18 inches) just below the dam and continuing downstream for about 0.5 miles, gradually thinning until only a light covering of fine silt was deposited a the confluence with the Napa river (DFG, July 1992; DFG Aug 1992).

In a letter dated August 4, 1992, John Emig of DFG reported that two days after the 1992 release, "pools were filled in, riffles were covered, and extensive deposits were found on stream banks. The stream was highly turbid throughout the entire downstream area." Mr. Emig also informally counted the following dead aquatic species: 1 rainbow trout, 6 crayfish, 7 sculpin, 109 tadpoles, 139 golden shiners. According to an October 1992 synopsis of the release, "there [was] a total loss of aquatic life. The organisms which formerly survived had been smothered by the silt as it was deposited on the stream bottom" (DFG, Oct 1992).

Future without project conditions assumes that the dam would remain in place and that the threat of sediment release and fish and aquatic organism kills remains. It is possible that the non-Federal sponsor would periodically remove sediment from behind the dam which would temporarily lower the threat of sediment releases and fish kills downstream. However, only removal of the accumulated sediment coupled with the removal or breaching of the dam to allow for natural sediment transport could permanently reduce the threat of downstream sediment release and aquatic organism kills in the future.

- **PROBLEM: Upper York Creek Dam has caused aquatic and riparian habitat degradation upstream of the dam.**

Upper York Creek Dam, and sediment accumulation due to the dam, has destroyed approximately 3 acres of aquatic and riparian habitat above the dam. Originally the reservoir was dug for water supply purposes and had a 10,000,000 gallon storage capacity. Today, the original creek bed is buried beneath 17 to 29 feet (approximately 28,000 total cubic yards) of accumulated sediment).

The riparian and aquatic habitat in the project area has been compromised for over 100 years due to the presence of the dam and reservoir. Riparian habitats immediately upstream and downstream of the project are comprised of lush riparian habitat whereas the project site riparian habitat is sparse and limited. It is believed that a restored aquatic and riparian corridor through the project site would better

support native populations of riparian and aquatic wildlife species by providing increased canopy, cover, foraging, and shelter habitat.

A temporary wetland complex had begun to develop over the accumulated sediment as the sediment basin is filled with annual flows. However, this is not the natural habitat type for this location.

Future without project conditions assume that Upper York Creek Dam would not be removed. The natural habitat has been degraded by construction of the dam, and neglect. This has resulted in a large influx of sediment that has created a sediment basin behind the dam that gets larger each year.

The 2005-2006 storm season led to the additional accumulation of approximately 8,000 cubic yards of sediment. The sediment accumulated both within the sediment basin and upstream of the reservoir. This suggests that without project conditions will lead to additional sedimentation both within and upstream of the project area.

It is possible that the non-Federal sponsor would periodically remove sediment from behind the dam. These future maintenance efforts would likely inhibit the growth of riparian vegetation and would favor the growth of exotic vegetation.

Without the project, further aquatic and riparian habitat degradation is expected.

3.5.2 OPPORTUNITIES

- **OPPORTUNITY: To provide connectivity for ecological processes for all fish and wildlife species that live in the aquatic and riparian habitat upstream or downstream of the dam**

  Upper York Creek Dam acts as an ecological barrier to fish and wildlife species that live within the creek. The removal of the dam would restore the natural connectivity of the riverine habitat(s) and would allow fish and wildlife populations to disperse and migrate naturally migrate though their natural habitat range.

  Future without project conditions assume that Upper York Creek Dam would not be removed. The dam would remain as a barrier to natural fisheries and wildlife populations.

- **OPPORTUNITY: To beneficially reuse the dam material and sediment at various project sites.**

  There is an opportunity to beneficially reuse the project sediment and dam material at various locations. These opportunities include potential reuse at the City's Lower Reservoir. Other opportunities include reuse at private vineyards or for the City's flood control project at Fulton Lane.

3.6 PLANNING OBJECTIVES

The national objectives are general statements and not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the without project conditions. The planning objectives are specified as follows:

- **OBJECTIVE: Improve fish passage.** To restore the natural aquatic migration and dispersal corridor for all life stages of the federally listed CCC steelhead in the York Creek watershed by reconnecting spawning, rearing, and migratory aquatic habitat from downstream of the dam to approximately 2 miles upstream.

- **OBJECTIVE: Reduce future downstream habitat degradation and fish kills.** To reduce the risk of uncontrolled sediment releases that have been shown to cause fish and aquatic organism kills downstream of the dam and to restore a natural sediment transport system (fluvial process) through the project area.

- **OBJECTIVE: Habitat Restoration.** To restore approximately 3 acres of degraded riparian and riverine habitat at and above Upper York Creek Dam.

- **OBJECTIVE: Connectivity.** To provide aquatic and riparian migration and dispersal connectivity for fish and wildlife populations through the project site.

3.7 PLANNING CONSTRAINTS

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study are as follows:

- **CONSTRAINT: Species of Concern.** There are potentially a number of state and federally listed species such as the California freshwater shrimp, northern spotted owl, and steelhead. As of June 2006, completed wildlife surveys have not found any of these species at the project site. The Corps will use existing survey information and/or complete further surveys, as necessary, to determine the presence of threatened and endangered (T&E) species at the project site. It is believed that current project alternatives would benefit most T&E species and that minimally, that they would not negatively impact these species. If implemented, the Corps will use best management construction practices to minimize construction-related impacts to T&E species.

- **CONSTRAINT: Spring Mountain Road.** Spring Mountain Road is owned by Napa County and is a major conduit between St. Helena and Santa Rosa as well as to wineries located between the two cities. Landslide and road stability near the dam area is a concern because there are no feasible alternate route. The Corps will

continue to work with the City and Napa County to ensure that the project would not jeopardize the stability of the road.

- **CONSTRAINT: Utilities and other existing structures.** Modifications to the dam and construction activities cannot compromise the integrity or stability of utilities.

3.8 DESIGN CONSIDERATIONS

The below considerations have been taken into account for the design of project alternatives.

- **CONSIDERATION: Construction Access.** Access to the project area is difficult due to: 1) the location of the dam and creek channel immediately adjacent to a public road; 2) the configuration of the project site; and 3) instability of the channel sides. These factors would create challenges to construction mobilization and demobilization.

- **CONSIDERATION: Construction Window.** The window for in-stream construction work is June 15 to October 15 of each year due to agency regulations and wildlife lifecycles.

- **CONSIDERATION: Erosion.** Project alternatives should strive to reduce erosion in the stream corridor.

- **CONSIDERATION: Hardened Structures.** Resource agencies have expressed concern about the Corps' use of hardened structures and concrete. The Corps would work to mimic natural habitat configurations, limit the use of riprap where possible, and use no walls or gabion, to the extent possible.

- **CONSIDERATION: Natural "Waterfall" Rock Outcrop Beneath Dam.** A rock outcrop under the dam could cause more difficulty when trying to construct a stream for fish passage as a natural outcropping could prove to be a pre-existing fish passage barrier. The natural geology of the project area would be studied, to the extent possible, during feasibility. Because it would be enormously expensive, as well as seemingly unnecessary, to do extensive underground geological investigations, adaptive management would need to be followed once the dam is removed and/or notched. This would allow the construction team to determine how to best utilize the natural geology of the project site for creek construction.

- **CONSIDERATION: Spring Mountain Road.** The Corps would work with the City and County to plan for construction related traffic impacts on Spring Mountain Road.

- **CONSIDERATION: Water Quality.** Construction activities should be conducted so as not to degrade water quality downstream of the project site.

3.9 PLANNING CONSIDERATIONS

- **CONSIDERATION: Comply with local land use plans.** Community plans and guidelines have been created by the City of St. Helena and other local stakeholders. To the extent possible, the Corps would follow the guidelines established by the City of St. Helena's General Plan as well as the Community Coalition for a Napa River Flood Management Plan/Design Review Committee's "Goals and Objectives for a "Living" Napa River System."

- **CONSIDERATION: Environmental Operating Principles.** The Corps has reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles" applicable to all its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation, and restoration in all Corps activities. The Environmental Operating Principles are:

    - Achieve Environmental Sustainability.
    - Consider Environmental Consequences.
    - Seek Balance and Synergy.
    - Accept Responsibility.
    - Mitigate Effects.
    - Understand the Environment.
    - Respect Other Views.

- **CONSIDERATION: Operations and Maintenance (O&M).** The City of St. Helena prefers alternatives that minimize future O&M.

- **CONSIDERATION: Redwood Trees.** Regulatory agencies have expressed a concern to preserve the large redwood trees that have grown on the downstream face of the dam. The Corps will continue to work with regulatory agencies to ensure that any loss of large redwood trees, necessary for the selected alternative, is unavoidable and will plant redwoods within the project site for replacement. Additionally, the revegetation and restoration plan currently includes the planting of redwood trees.

- **CONSIDERATION: Safety and Recreation.** Public safety in the project area must be considered both during and after construction.

- **CONSIDERATION: Water Supply or Flood Control Impacts.** The Corps would avoid or mitigate for negative adverse effects on water supply, and flood control impacts.


Figures 3.1 and 3.2. Lower Reservoir

3.10 MEASURES

A measure is a feature or an activity that can be implemented at a specific geographic location to address one or more planning objectives.

3.10.1 PRELIMINARY MEASURES

The Corps Project Delivery Team (PDT) held its initial Preliminary Alternatives meeting on November 20, 2003, where measures were brainstormed to address the problems and opportunities that came out of the July 9, 2003 "problems and opportunities" brainstorming meeting.

The purpose of the brainstorming session was to consider all possible measures for addressing the objectives. Many of these measures were quickly eliminated from consideration because they were infeasible and/or unacceptable. This initial list of measures can be read in Appendix L: Plan Formulation. The table below is the second iteration of measures from the brainstorming session. As seen in this table, these measures were either retained or dropped for further consideration.

Table 3.2. Summary of Preliminary Screened Measures for Preliminary Project Objectives.

Measure	Retained	Dropped	Rational
Objective: Improve Fish Passage			
Build fish ladder	X		Measure is included for Alternative 3
Dam Removal	X		Measure included for Alt 1
Dam Removal and regrade	X		Measure included for Alt 1
Notch/Partial removal of dam	X		Measure included for Alts 2A, 2B, 3
Sediment Removal	X		Measure is included in all action Alternatives
Increase flow		X	No water source and does not meet restoration objectives.

Fish bypass		X	Topographically infeasible to construct in site's narrow canyon
Fish escalator		X	Cost prohibitive/Not practical in this watershed
Fish hatchery		X	Does not meet objectives for natural fish passage or restoration
Fish lift		X	Cost prohibitive/Not practical in this watershed
Fish tube		X	Cost prohibitive/Not practical in this watershed
Landscape improvement		X	Measure included in all action alternatives
Reroute creek around dam		X	Topographically infeasible to construct in site's narrow canyon
Restore instream habitat	X		Measure included in all action alternatives
Trap and truck fish around dam		X	Cost prohibitive/Not practical in this watershed
Objective: Eliminate threat of downstream fish and aquatic wildlife kills due to sediment releases			
Sediment Removal	X		Measure included in all action alternatives
Leave sediment/take no action	X		Measure part of "No action alterative."
Relocate sediment somewhere allowable	X		Measure included in all action alternatives
Reuse sediment at project site	X		Measure included in all action alternatives
Stabilize sediment to reduce threat of catastrophic release	X		Erosion control and revegetation would be used to stabilize remaining sediment
Stabilize existing sediment		X	Does not meet overall project objectives
Watershed sedimentation management		X	Not within scope of this project.
Objective: Reduce Erosion*			
Bioengineering techniques	X		Such measures are included in all action alternatives
Do nothing	X		No Action Alternative
Grade control measures	X		Please refer to specific measures: J-hook weirs, etc.
Leave large trees to reduce erosive effects of rainfall	X		Revegetation Feature.
Meanders	X		Measure included in all action alternatives
Plant aquatic vegetation	X		Revegetation Feature.
Plant deep-rooted vegetation	X		Revegetation Feature.
Regrade and stabilize stream banks	X		Measure included in all action alternatives

Rip rap	X		Measure included in all action alternatives
Animal access: Restrict		X	Not Necessary
Buy out vineyards and revegetation		X	Not feasible due to expense.
Concrete trapezoidal channel		X	Does not meet restoration objectives
Public access: Restrict		X	Not Necessary
Sand bags		X	Not Necessary
Silt curtains	X		Design and Implementation phase detail
Objective: Habitat Restoration			
Aquatic Habitat Creation: Boulders, Large Woody Debris, Plant shade canopy plants	X		Incorporated into planning; to be further assessed in the Design and Implementation Phase.
Do nothing	X		No Action Alternative
Channel Design: Mimic Natural Design (Meanders, pools, riffles)	X		Measure included in all action alternatives
Riparian revegetation with native vegetation	X		Revegetation Feature.
Sediment Removal	X		Measure included in all action alternatives
Floodplain terrace banks	X		Included in Alternatives 1, 2A
Passive Restoration of Vegetation		X	Inappropriate; erosion and invasive vegetation concerns
Public access limitation		X	Not necessary

* Preliminary Objective; this objective was not retained for final array of objectives.

3.10.1 FINAL MEASURES

Generally, measures are the building blocks that are grouped together to form alternative plans. The measures listed above were screened through meetings and the planning design phase to determine whether each measure should be retained for use in the formulation of the final array of alternative plans. Table 3.2 is a summary of the measures included in the final array of alternatives for feasibility analysis. Please refer to the Plan Formulation Appendix for the original array of measures.

Table 3.2. Summary of Final Measures and the Project Objectives Each Measure Meets.

General Measures	Objectives			
	Improve fish passage	**Reduce risk of sediment release**	**Habitat Restoration**	**Aquatic Connectivity**
Aquatic Habitat Creation: Boulders, Large Woody Debris, Plant shade canopy plants	**X**		**X**	
Channel Restoration (Includes creation of aquatic habitat: meanders, pools, riffles)	**X**		**X**	**X**
Dam Removal	**X**		**X**	**X**
Erosion Control		**X**	**X**	
Fish ladder	**X**			**X**
Floodplain terrace banks			**X**	
Notch/Partial Removal of Dam	**X**		**X**	**X**
Revegetation	**X**		**X**	
Sediment Removal and disposal/reuse	**X**	**X**	**X**	**X**

3.10.1.1 Description of Final Measures

Channel Restoration and Creation of Aquatic Habitat

Channel restoration would include design features of pools, riffles, and runs in the channel. Specifically, pools, riffles, and runs would be incorporated into design. Local cobbles, woody debris, and other native material would be used to create the restored channel.

Dam Removal and disposal/reuse

The 50-foot high and 140-foot-long earthen dam (16,284 cubic yards of material) would be removed, as wood the right wall of the 225-foot-long concrete spillway, the 6-foot diameter steel riser pipe, and trash rack. This would restore fish passage through the dam site. Two potential disposal sites have been identified for this project. The first site is the City's lower off-stream reservoir to York Creek (Lower Reservoir), which is located about one mile down Spring Mountain Road from the project site. The second location is Clover Flats, a permitted landfill that is located within 10 miles of the project site.

Erosion Control

Permanent erosion control vegetation in habitat areas would consist of native vegetation. Erosion control for disturbance from construction activities outside habitat areas would consist of grasses best suited for the areas needing protection.

Fish ladder

The fish ladder would allow for fish passage over the dam. The dam would be lowered as necessary to construct a concrete fish ladder through the notch and over the dam. This would provide for upstream steelhead migration.

Floodplain terrace banks

The creation of floodplain terraces were favored by resource agencies in order to provide for more potential riparian habitat.

Notch/Partial Removal of Dam

A notch or partial removal of the dam would require the removal of approximately 70% of the earthen dam structure. A restored creek would then be constructed though the dam site.

Revegetation

Habitat revegetation would provide roughly 2 acres of riparian vegetation, erosion control, and shade canopy for aquatic and wildlife species. This is the disturbed area for all alternatives.

Sediment Removal and disposal/reuse

Accumulated sediment would need to be removed to create a restored creek through the project site. The material would be sorted, and materials necessary for restoration would be stockpiled. The remaining material would be taken to off-site areas for storage and reuse. As with the dam material, two primary disposal sites have been identified. The first site is the Lower Reservoir, and the second is Clover Flats.

3.11 FORMULATION AND EVALUATION OF PRELIMINARY ALTERNATIVES

A preliminary and then a final array of alternatives were developed, evaluated, and compared to identify a plan that reasonably maximizes the NER benefits. It is important to note that the preliminary array of alternatives primarily focused on various measures to address the fish passage objective. This was done as this specific objective demanded the most intensive engineering and design effort for this restoration project. This objective also most directly affects the outcome of all project objectives.

Below is a list of general concepts that the Corps' PDT used to narrow down the possible measures to address fish passage. Generally, these concepts range from alternatives focused on full dam removal to those avoiding removal while still attempting to achieve fish and aquatic organism passage.

General Concepts for Alternative Development:

- Remove dam and build a support structure for slope stability.
- Remove dam and re-route road to avoid slope stability issues.
- Modify or notch the dam down to the stream bed.
- Modify or notch the dam part way to stream bed and build a fish ladder or fish passage structure over remaining dam.
- Do not remove or modify the dam. Build a new fish ladder or fish passage structure over dam.
- Re-route the creek around dam.

Based on the above concepts, the following is a list of preliminary alternatives that were developed. Included is a general description of the initial seven alternatives.

3.11.1 PRELIMINARY ALTERNATIVES:

- No-Action
- Alternative 1 - Remove dam and build support structure for slope stability.
- Alternative 2 - Remove dam and re-route road to avoid slope stability issues.
- Alternative 3 - Modify (notch/lower) dam to stream bed to create hydrologic connectivity.
- Alternative 4 - Modify (notch/lower) dam part way to stream bed and build fish ladder.
- Alternative 5 – Do not remove or modify dam. Build a fish ladder over dam.
- Alternative 6 – Re-route York Creek around dam.

Table 3-4. Preliminary List of Alternatives.

Al #	Description of Alternative	Retained	Dropped	Rational
No Action		X		
1	Remove dam and build support structure for road	X		
2	Remove dam and reroute road		X	Not effective. There is no feasible alternate route.
3	Modify (notch/lower) dam to stream bed	X		
4	Modify (notch/lower) dam part way to stream bed and construct fish ladder	X		
5	Dam remains as is with a new fish ladder		X	Not efficient. Constructing a ladder over a 50 foot dam to a level above the natural streambed is impractical for fish passage.
6	Reroute creek		X	Neither effective nor efficient. There is no feasible alternative route without blasting through canyon walls to an alternative watershed.

3.11.1.1 No Action Alternative

This alternative means to do nothing. The Corps is required to consider the option of "No-Action" as one of the alternative plans in order to comply with the requirements of the National Environmental Policy Act (NEPA). With the No-Action alternative, which is synonymous with the "future without-project condition," it is assumed that no project would be implemented by the federal government or by the local interests to achieve the planning objectives. The No-Action Alternative serves the planning process by providing the base against which all other alternatives are measured and ensuring that any action taken is more in the public interest than doing nothing.

3.11.1.2 Alternative 1- Remove dam and build support structure for slope stability

The preliminary version of Alternative 1 involved removing the dam, spillway, and all sediment behind the dam. The goal of this alternative was to maximize the hydrologic passage and to return the entire project area to a more natural state while enhancing fish and aquatic organism passage. The removal of these structures would require support structures for the slope and specifically for maintaining the integrity of Spring Mountain Road. If necessary, a structure would be built to help support/stabilize Spring Mountain Road.

Initial geotechnical investigations found that although Alternative 1 seemingly provided for the most effective restoration of a natural creek system, that complete removal of the dam, spillway, and sediment could results in the greatest slope failure risk. This would likely require the greatest amount of effort to maintain the Spring Mountain Road. Extensive explorations, complex design, and a large construction cost would likely be required and it was thought that this could be beyond the scope of a CAP section 206 project.

3.11.1.3 Alternative 2 - Remove dam and re-route road to avoid slope stability issues

Alternative 2 was removed from study consideration as it became clear in discussions with the City of St. Helena, that re-routing Spring Mountain Road was not a feasible option. Spring Mountain Road is owned by Napa County and is a major conduit between St. Helena and Santa Rosa as well as to wineries located between the two cities. There is no other feasible alternate route.

3.11.1.4 Alternative 3 - Modify (notch/lower) dam to stream bed to create hydrologic connectivity

The preliminary version of Alternative 3 involved removing a portion of the dam and leaving the spillway in place (i.e., "cutting a notch" in the dam). The goal of this alternative is to allow for adequate fish passage while minimizing the total alternative costs and thus removing only necessary sediment from behind the dam to meet project objectives. Initial geotechnical analysis found that notching the dam would have less impact on slope stability integrity as well as the integrity of Spring Mountain Road. If necessary, a structure(s) would be built to help support/stabilize Spring Mountain Road.

The Site and Alternatives Evaluation report produced by the Sacramento District Army Corps of Engineers found that the notch should be located as far toward the right bank as possible (looking

downstream) to maximize slope stability and the integrity of Spring Mountain Road. The report also recommended that the notch be excavated such that the cut slopes are 1.5H to 1.0V. Erosion protection is recommended at the toe of the new cut slopes in the vicinity of the dam.

To the extent feasible, the natural channel dimensions used for Alternative 1 should be constructed through and above the notch.

3.11.1.5 Alternative 4 - Modify (notch/lower) dam part way to stream bed and build fish ladder

Alternative 4 involves removing a portion of the dam, or possibly excavating a notch in the dam, and constructing a new fish ladder through the notch. A fish ladder was one of the first alternatives considered conceptually in the planning process. Initial investigations into various fish ladders found that a ladder could potentially provide juvenile passage, be installed without requiring demolition of the dam, and involve less earth grading upstream of the dam. Selection of a fish ladder style depends on a number of factors, including fish species and age class, scale of channel, hydrology, flow control available, and the channel debris and sediment load. York Creek is a small, non-gauged creek with large variation in flows and unknown debris and sediment load, which makes selection of an appropriate fish ladder difficult. Ladders that can accommodate very low flows - like pool and weir and Denil types - cannot operate over a wide variety of flows and are affected by sediment and debris.

3.11.1.6 Alternative 5 – Do not remove or modify dam. Build a fish ladder over dam.

Alternative 5 was removed from study consideration as building a fish ladder up and over a 50 foot tall dam proved impractical for fish passage as well as cost prohibitive. The most suitable fish passage structures for this option are Denil or Steeppass fishways. These structures would most likely have a steep gradient that would be difficult for fish to navigate and may require a significant amount of maintenance.

3.11.1.7 Alternative 6 – Re-route York Creek around dam.

Alternative 6 was removed from the study list. At the project location, the creek flows through a narrow canyon and there is no practical alignment to reroute the creek aside from blasting though the canyon walls to another watershed. This was considered inefficient and ineffective and would not meet the objectives of fish passage and habitat improvement.